

VOLUME 32, NO.3

• THE GEORGE WASHINGTON UNIVERSITY

• EDITION 1, FALL 1985

# MECHANICAL



PUBLISHED BY THE ENGINEERS' COUNCIL IN COOPERATION WITH THE ENGINEER ALUMNI ASSOCIATION



# Student Professional Awareness Conference



THE INSTITUTE OF  
ELECTRICAL AND  
ELECTRONICS  
ENGINEERS, INC.

**Free** to all SEAS students and faculty

**The George Washington University** \_\_\_\_\_

Thursday, October 17, 1985 • 1:30-8:30 pm  
Marvin Center, 800 21st Street, NW, Washington, DC

## Program

Dorothy Betts, Marvin Theater,  
Marvin Center, 1st Floor:

- 1:30 Welcome by Dr. Harold  
Liebowitz, Dean
- 1:45 Joseph DeSalvo: "Where Do  
We Go From Here With  
Our Lives?"
- 2:45 Larry Dwon: "The Art of  
Becoming Employed"
- 3:30 Refreshments Break
- 4:00 Dr. Aaron Collins:  
"Professional Development  
Through Advanced Degrees"
- 5:00 Hans Cherney: "Engineering  
Professionalism and the IEEE"
- 6:00 DINNER (Reservations must  
be made by October 3, 1985)
- 7:30 James Watson: "The  
Communications  
Connection"

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COVER: Smoke rings curl in intricate patterns as they emerge from a duct. Photo courtesy of the GW propulsion laboratory.

### Of Smoke Rings and Submarines: Applications of Fluid Flow Visualization

by Jamshid Z. Irdmusa

What do a curveball, a Trident submarine, and a CAT scanner have in common? Find out as we explore the fascinating science of fluid flow visualization and its impact on today's technology.

4

### No More Index Cards: The IRS Computerizes

by April Stokes

Chaos becomes calm at the IRS's Manhattan District office with the addition of a new computer filing system. However, some "bugs" must still be ironed out before the IRS becomes a model for efficiency.

7

## TECH BRIEFS

Edited by Lilimar Avelino

New in MECHELECIV this fall, TECH BRIEFS give short, insightful reports on the latest-breaking developments in science and technology. In this issue, learn about a "hi-tech" world's fair, a medical pocket ID card, the world's largest telescope, and more!

8

## Departments

**From the Engineer Alumni**

**Association** ..... 2

**Campus News** ..... 13

MECHELECIV is a student and alumni magazine published 4 times a year (twice each semester) at the George Washington University by the direction of the Engineers' Council and in cooperation with the Engineer Alumni Association.

MECHELECIV serves the Engineering School community as a responsible student/alumni magazine, independent of the School and University administration in its management and decision making.

MECHELECIV is managed and administered in accordance with the "Policy and Procedures Governing the Cooperative Publication of MECHELECIV by Engineers' Council and Engineer Alumni Association". This document was agreed upon and signed on September 20th, 1984 by the Engineers' Council and the Engineer Alumni Association.

Subscription: \$2.00 per year. Circulation: 10,000. ISSN#: 0047-6387. Second class postage paid at Washington, D.C.

Address all communications to: MECHELECIV, Davis-Hodgkins House, 2142 G Street, N.W., Washington, D.C. 20037 or call (202) 676-3998.

POSTMASTER: Please send address changes to: MECHELECIV, Davis-Hodgkins House, School of Engineering and Applied Science, Washington, D.C. 20052.

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# FROM THE ENGINEER ALUMNI ASSOCIATION

## From the EAA President



Welcome to the second year of the joint sponsorship of the publication of MECHELECIV magazine by the Engineers' Council and the Engineer Alumni Association. This year the EAA is sponsoring only two of the four issues—the first and the last. If you would like to receive all four issues, **be sure to return the subscription card from the back cover.**

The EAA has planned several interesting events for this year, and we hope that many of you will take advantage of these opportunities to meet with other engineering alumni, as well as the students and faculty of SEAS. Sincerely,

Mary O. Jones  
President, EAA

## Results of EAA Elections

In the spring, the EAA held elections for membership to the Board of Directors. Congratulations are offered to the

following alumni who have been elected to the following terms:

Three-year term: Inam Ghazali (new member)  
Richard Hu  
Mary O. Jones  
Jay Mendlebaum (new member)  
Diego Roque

One-year term: Jeffrey Meeker (new member)

At the annual meeting of the EAA in June, the activities of the past year were reviewed and officers were elected for the 1985-86 year. The following officers were elected:

President: Mary O. Jones  
Vice-President: Dudley J. Schwartz  
Secretary: Edwin Stengard  
Treasurer: Nahid Khozeimeh

## Upcoming Events

September 28, 1985

SEAS Annual Picnic

November, 1985 Back-to-School Function

Spring, 1986

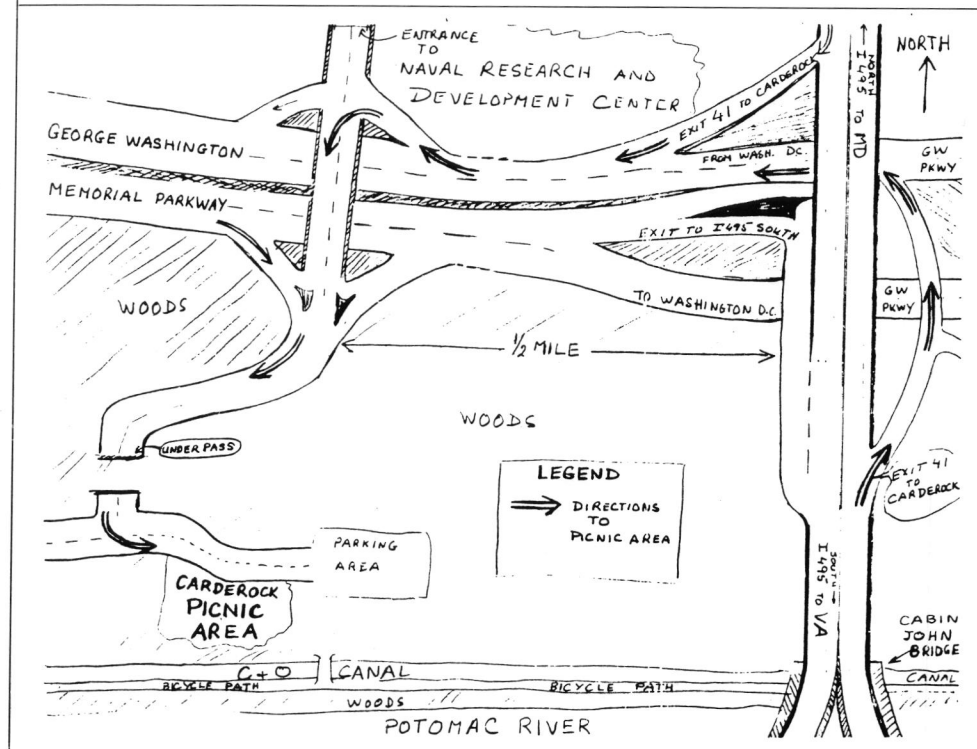
Dean's Reception

Spring, 1986

Embassy Reception

## Annual Engineering School Picnic—September 28, 1985

The annual SEAS picnic will be held on Saturday, September 28, 1985 from noon until dark at the National Park Picnic Area at Carderock, Maryland, overlooking the Potomac River. This event is sponsored jointly by the Engineer Alumni Association, the Engineers' Council, and Omega Rho Honor Society. The event offers an opportunity for alumni, students, and faculty to socialize and compete in athletic events. The food and drinks are **free!** Contact the Alumni House at (202) 676-6435 or the Engineers' Council at (202) 676-6744 before September 26 if you wish to attend. See the map below for directions or call the Park Police at (202) 492-6293.



# A l u m n i

We are looking to do "what are they doing now"—type feature interviews with alumni who have been successful in their chosen fields (engineering or otherwise). If you know of an alumnus who has achieved prominence and whose story you think would interest our readers, please call (202) 676-3998 or write to:

## **MECHELECIV**

2142 G Street, N.W., Room 203  
Washington, D.C. 20037

*We will provide a staff member and photographer for people in the Washington area. For those outside the Washington area, we will arrange to conduct the interview by telephone.*

# OF SMOKE RINGS

## APPLICATIONS OF FLUID

by Jamshid Z. Irdmusa

**"H**AVE YOU ever wondered why submarines are long and fish-shaped? Or why sports cars are sleek and low-strung? Or why a curveball thrown by a baseball pitcher can strike a good hitter out?

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**"In the decade since the energy crisis, flow visualization has played an important part in revealing criteria for the better design of ships, aircraft, and automobiles."**

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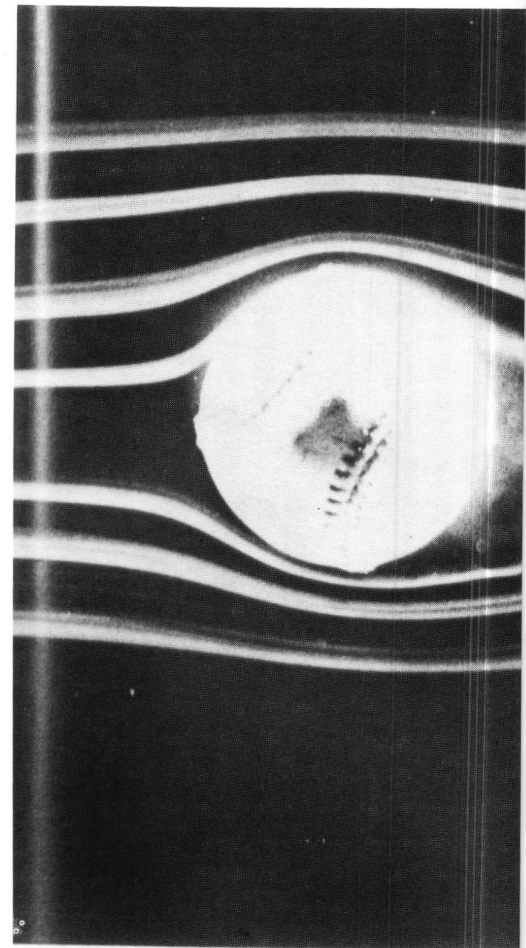
All of the above can be explained by the basic theory of fluid

**Right:** Do you know why a curveball curves? This striking photograph of the flow over a spinning baseball demonstrates the separation taking place behind the ball, causing it to "curve" or "break" in different directions. Photo courtesy of T.J. . Mueller.

mechanics. Classical fluid mechanics (as developed by Sir Isaac Newton and others) provides us with an accurate tool for solving fluid dynamics problems (problems involving the motion of a fluid.) Often, though, it is difficult to come up with numerical solutions to these problems.

It is then that the science of **flow visualization** becomes important. By simply observing how the flow around an object moves, engineers can accurately predict the motion of that object in either a gas or a liquid. In this article, I will discuss some techniques of flow visualization, including those used here at George Washington. These techniques are producing results that are continually helping engineers design faster and more efficient air, land, and seagoing vehicles.

**"B**EFORE THE energy crisis of the 1970s, it was thought that little could be done to improve aerodynamic efficiency. Since then, however, it has become increasingly important to conserve energy. The result has been the fast turnover from blunt-shaped bodies to so-called **aerodynamic** bodies. Throughout this period, flow visualization has played an important part in

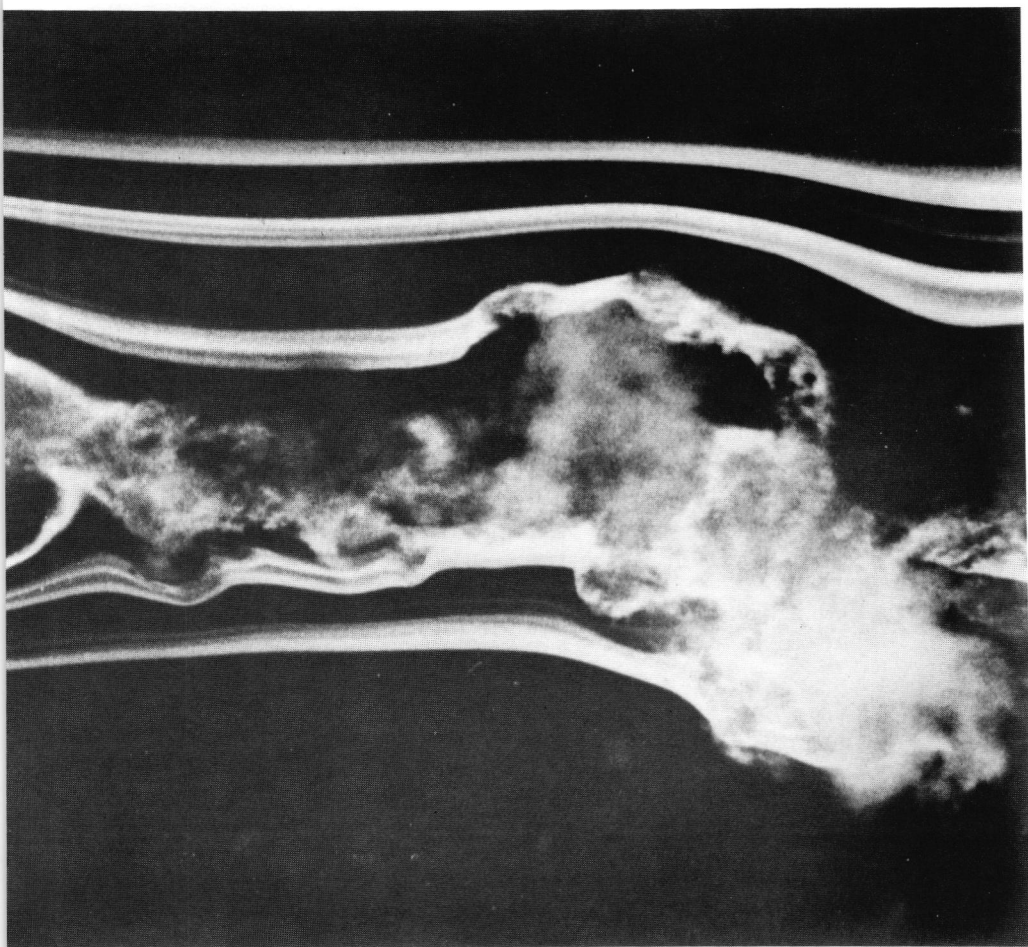


revealing criteria for better design of ships, submarines, aircraft, and automobiles.

Flow visualization can be readily divided into two categories: air flow visualization and water flow visualization. Generally, water flow visualization is easier than that of air, due to both lower velocities and lower turbulence levels in water. Sometimes, the motion of an object in air is even simulated by its corresponding

# AND SUBMARINES:

## FLOW VISUALIZATION



motion in water. This is known as **similitude**, and it is a powerful technique for making difficult problems simple (a favorite goal of laboratory engineers!)

Air flow visualization is extensively used in designing the bodies of vehicles. It is done by injecting smoke into the air, which is blown over a model of the actual vehicle. The flow of air moving over the model carries the smoke particles and makes it possible to

see the points where the flow separates or leaves the contours of the body. These points of separation cause a local drop in pressure, which leads to higher body drag. After locating these points, the model is modified several times until the drag is minimized. In general, lowering the value of drag brings about greater aerodynamic efficiency.

The smoke used for this type of experiment can be easily generated

from tobacco, dry ice, or burning oil. Dry ice ( $\text{CO}_2$ ) is a cheap source of smoke, when dissolved in water, because of the high volumes of smoke it creates. This is, by the way, the same method used to create mists or fogs in movies or in the theater.

Another interesting example of air flow visualization is the smoke ring. Almost everyone has seen a smoke ring, or perhaps you've even generated one if you smoke cigarettes. You can form a smoke ring just by inhaling cigarette smoke and blowing it out through rounded lips. Scientifically speaking, this is nothing more than the flow visualization of a pulsed jet through a circular nozzle. A large number of researchers in the field of propulsion generated smoke rings and studied their properties, such as formation time, structure, size, and decay time. The results have been used to predict the performance of pulsating ejectors for producing thrust in jet engines or rockets (more on ejectors later.)

Due to the high speeds and high diffusion rates of smoke in air, the human eye is not quick enough to record the flow patterns.

Therefore, electronic and optical equipment is used. A high speed camera can provide sequential

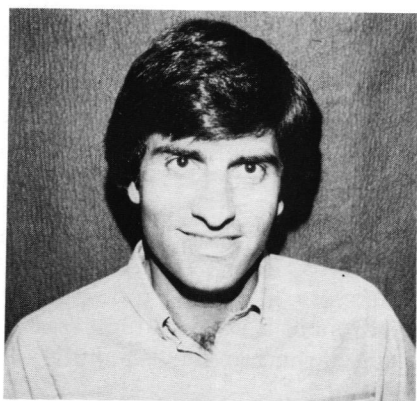
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**"Scientifically speaking, a smoke ring is nothing more than the flow visualization of a pulsed jet through a circular nozzle."**

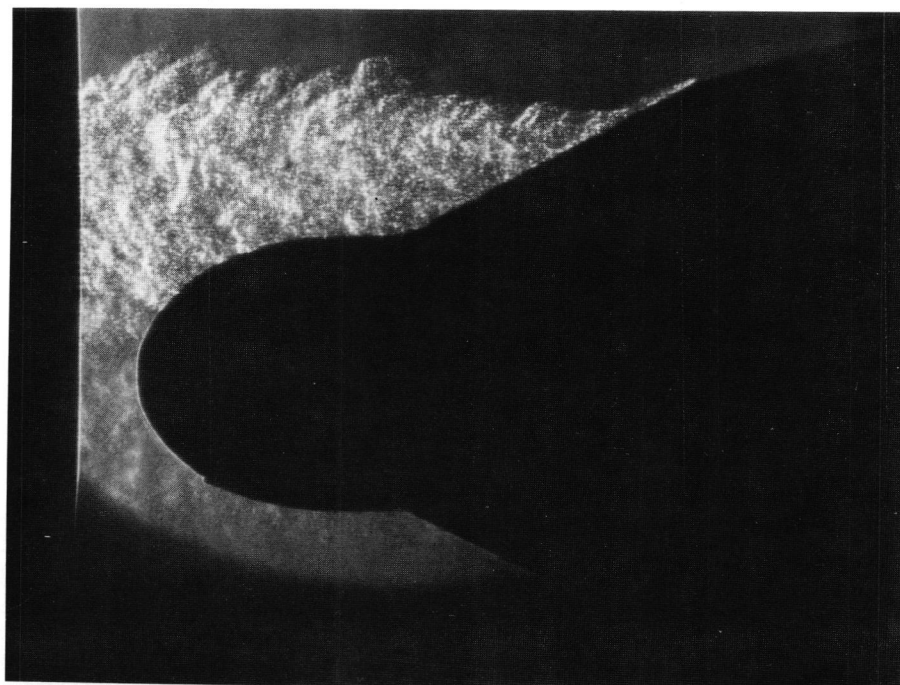
movies of the flow patterns up to 12, 000 frames per second. If sequential records of the patterns are not necessary, flashlights with extremely short duration (within a few microseconds) are used.

**“W**HEN there is a temperature differential (change of temperature) across the flow field, electro-optical techniques, such as **shadowgraphy, interferometry, or schlieren photography** are used. Essentially, these techniques are similar in that they pick up the refraction patterns of colliding light beams so that the different regions of the flow field are distinguishable in a photograph. For example, a hotter region in the field will show up a lighter color, as opposed to a colder one, which will be darker. Very often, these methods are used in the study of supersonic flows and heat transfer problems, in order to actually visualize shock and heat waves.

In water, flow visualization is performed by injecting dye into the water flowing over a body or into a channel or nozzle. The dye is usually injected in a thin stream so that it can follow the streamlines of the flow under study. An example of this technique you're probably familiar with is the CAT (Computer Assisted Tomography) Scanner used now in most hospitals. Here, sometimes, dye is



*Jamshid Z. Irdmusa is a doctoral student at George Washington in the area of fluid and thermal science. He received his Bachelors and Masters Degrees from GW and is a member of ASME and Tau Beta Pi. The topic of his dissertation is flows through rotating nozzles and their utilization in crypto steady devices.*



*This schlieren photograph captures the flow of gas coming out of the spinning end of a rotating ejector. The ejector is used to study ways of providing thrust augmentation or increased thrust for propulsion. Photo courtesy of the GW Propulsion Laboratory.*

injected into the patient, and its movement through an area of the patient's body is scrutinized. There are also other ways of visualizing water flows, for example, injection of hydrogen bubbles or cosmetic materials like tetrachloride of magnesium. These types of flow visualization are used particularly when there is swirling or **vorticity** in the flow of water.

Here at The George Washington University, our propulsion research group, led by Dr. Joseph V. Foa and Dr. Charles A. Garriss, has carried out extensive research utilizing flow visualization techniques. We have used the methods of smoke injection and schlieren photography mentioned above to study complex flow patterns in various types of ejectors. An ejector is merely a duct attached to the rear of a jet engine or rocket that helps to augment or increase the thrust produced by that engine. One of our major projects involved studying smoke rings as they apply to pulsating or non-steady ejectors. From this study we were able to show that pulsating ejectors exhibit considerable energy losses, which engineers

had neglected all along. Often, flow visualization also helps us explain discrepancies between theoretical results predicted and numerical results obtained in the laboratory. Our laboratory is presently equipped with a complete schlieren system, a smoke generator, and a high speed camera of the type mentioned beforehand.

Engineers today use flow visualization as a strong tool in both predicting and solving fluid dynamics problems. Although sometimes for a complex flow problem, there is no solution available, flow visualization studies provide guidelines as to how the flow may behave. It is then possible to build a mathematical model based on what is seen from the flow patterns.

As problems become more and more complex, due to advancing technology, better techniques will be developed accordingly to assist researchers with flow visualization. All this will lead to faster, more efficient cars, airplanes, and submarines, and, no less importantly, to better insight into the mysteries of fluid flow, itself. ■

# NO MORE INDEX CARDS: COMPUTERIZING THE IRS

by April Stokes

**O**VERFLOWING file boxes and card tables with piles of paper surrounding them on the floor represent the decorum on the second floor of the Internal Revenue Service's Manhattan district office. IRS workers search for delinquent accounts in seemingly mountainous stacks of 5×6 inch ledger cards.

An entirely **different** scene can be found on the fifth floor. IRS agents with telephone headsets scan the silent screens of their computer terminals in search of taxpayers behind in their payments.

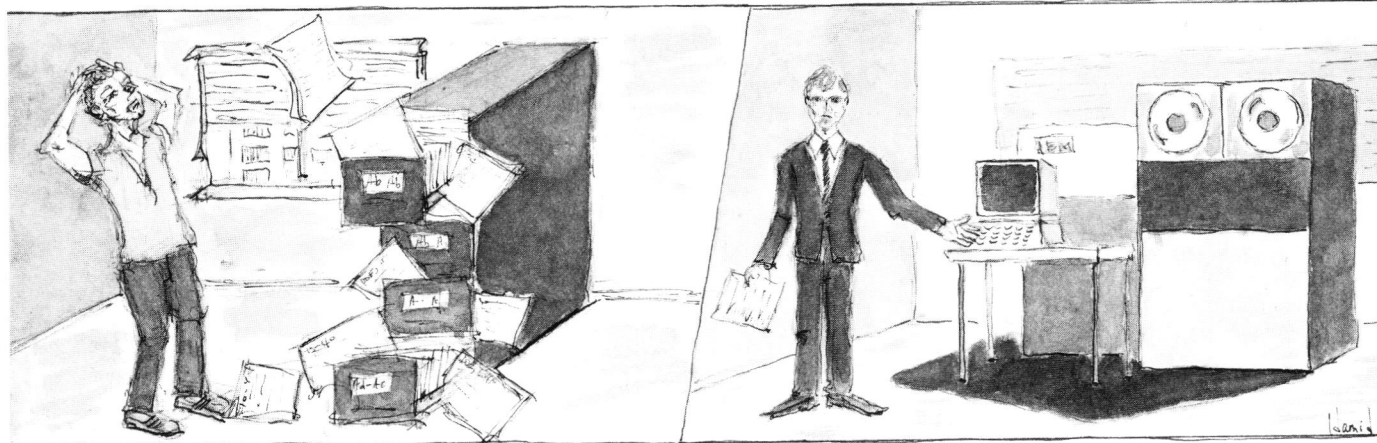
This more efficient work environment represents what is to come for the IRS. In fiscal 1984, it spent \$148.6 million on data processing, and the agency wants to spend twice that amount in fiscal 1985. This move into the computer revolution was the idea

allow the IRS to send out to a large number of taxpayers either bills or refunds automatically rather than having them file returns.

**T**HE IRS Computer Network includes data processing departments at its 10 service centers and 63 district offices. These are all tied into a national computer center in Martinsburg, West Virginia, which houses the IRS's master data base. This electronic ledger contains a list of taxpayer names, social security numbers, and account balances.

Delinquent accounts are ranked by the computers in order of priority, and when operators turn on their terminals, the most flagrant cases flash onto their screens first. The computer automatically dials the offender's phone number, and if the call does not go through, it will keep trying every 30 minutes for three hours

startup difficulties; others are from bad planning. For instance, IRS agents may need information from the IRS's master data base in the midst of a telephone call. However, these data are kept separately, and to gain access to them, agents have to walk over to another type of terminal. In addition, the IRS committed a basic mistake of the computer age: it did not have sufficient backup. The IRS did not have the money or the programmers to process tax returns on its old Control Data and Honeywell machines in case of emergency. A week before the April 15 deadline, the IRS had a backlog of 23 million returns to process, up from 15 million from 1984. In order to switch to the new system, IRS officials decided to rewrite 1,500 programs containing 3.5 million lines of code into COBOL, a more sophisticated computer language than the old system's assembly code. Further



of IRS Commissioner Roscoe L. Egger Jr., a 1981 appointee of President Reagan and former Price Waterhouse & Co. partner. Egger's solution to cutting back the IRS's growing workload can be divided into two parts. First, the automated collection system, which is presently in use, will not only collect taxes more efficiently but will also speed up internal processing. Secondly, the paperless filing system, which could start as early as 1987, will

before rescheduling the attempt. Once the taxpayer is on the phone, promises of payment are logged into the computer system. This automated system has already cut into half the number of staff workers in the Manhattan district collection office—largely by doing away with the overflowing file boxes.

At this early stage of development, the automated system understandably has some problems. Some stem from normal

delays were caused by late deliveries and repeated backdowns.

Even though the new system is causing considerable headaches, much of the equipment that would be needed to implement Egger's paperless filing plan is already in place. The new Sperry 1100/84 computers would calculate a taxpayer's debt or credit, based on IRS computer records of W-2 and 1099 forms, which report wages

*Continued on page 16*

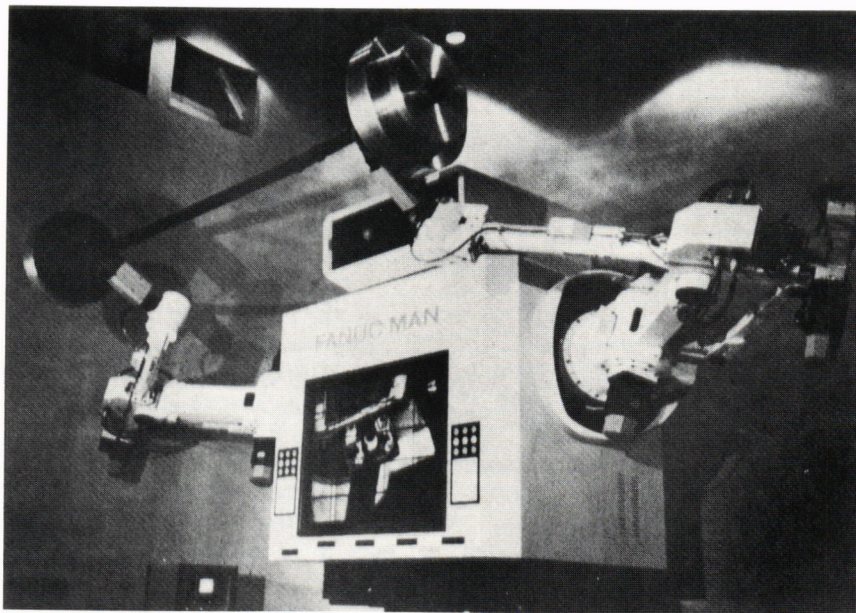
# TECH BRIEFS

## *Japanese Present Dazzling Visions of Tomorrow at Expo '85*

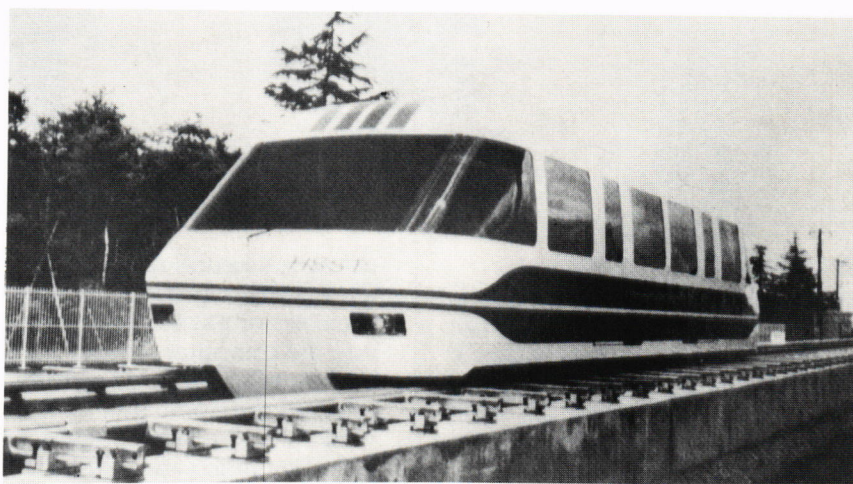
**O**N MARCH 17, Tsukuba, Japan launched Science Expo '85, a high technological world fair, displaying Japanese science today and world science tomorrow. The overwhelming theme of the fair is "Dwellings and Surroundings - Science and Technology for Man at Home." A futuristic setting is portrayed by the world's largest Ferris wheel, robots that walk, talk, draw pictures, carve, and play the organ, super computers, fabulous three-dimensional movies, gigantic television screens, simulated rides across deserts, and medical diagnostic machines. Overall, Science Expo '85 consists of pavilions and exhibits of over 250 corporations and organizations all over the world.

So many fascinating attractions encompass this world fair. For example, Fujitsu Corporation's pavilion features "Fanuc Man", a three-dimensional world history film, and a computer translation system. "Fanuc Man" is the world's largest humanoid robot, standing sixteen feet tall and weighing over twenty tons. It lifts a 440-lb. barbell and pictures a small model of itself on its belly with optical hand sensors. Fujitsu used Canada's Omnimax system and its Facom-380 supercomputer to put together a 3-D film entitled "We are Born of the Stars" in Cosmos Dome. The audience is given 3-D glasses, and they are taken on a trip through five billion years of Earth history within 500 seconds. The outstanding achievement is that all the images come from the Fujitsu main frame. Their translation system handles four languages at one time.

Hitachi's futuristic pavilion is



*"Fanuc Man" is the world's largest humanoid robot standing sixteen feet tall and weighing over twenty tons." Courtesy of Popular Science.*



*"Maglev's advantages are low energy consumption, a noise-free ride, and a maximum speed of 187 miles per hour." Courtesy of Popular Science.*

just as outstanding. At the audience's request, an advanced information system shows news, travel information and weather. An electronic photographic system produces sharp images on a screen and on a printer. The Robot Art Corner reveals an experimental robot waving at entering visitors. Meanwhile, three robots carve ice into any shape suggested by the people. This proves the outstanding dexterity of robots.

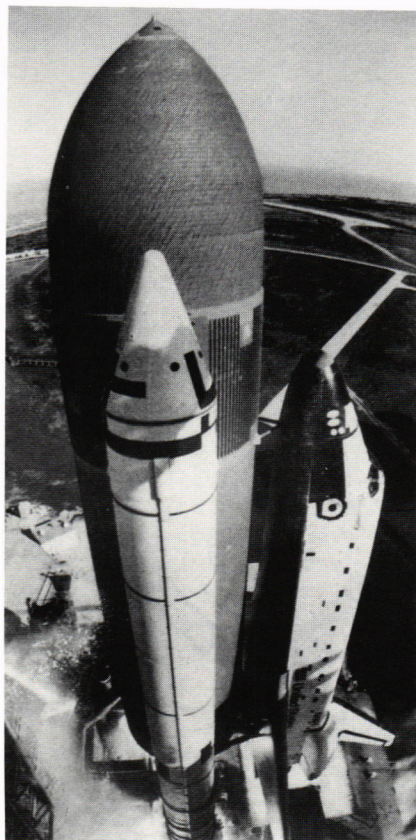
Other corporation like Sony, Fuyo, and Japanese Airlines took part in the fair. Sony highlighted their nine-story Jumbatron, which is a 16 x 25 foot digitized display screen. It has extraordinary brightness, 256 shades of every color, and uses only eight watts of electrical power. The Fuyo Robot Theater displayed a fake supersonic plane, and robots that interact with the visitors. Japanese Airlines introduced their maglev HSST-3, a high speed surface transport magnetically levitated vehicle 0.4 inches above its track. It is on a 230 foot track and runs twelve miles an hour. The maglev began running in 1974. Its advantages are low energy consumption, a noise-free ride, and a maximum speed of 187 miles per hour.

Japan's Tsukuba City, dedicated to research and development, hosts a spectacular look into the world of tomorrow. The Science Expo '85 world fair ends on September 16, 1985. Before concluding their futuristic vision, Science Expo '85 would like to convey that technology adapted to human needs can make life easier, more fun, and more satisfying for people all over the world.

*Lilimar Avelino*

## Shuttle Refitted for Future Flights

**T**ESTS, modifications, and flight plans on the U. S. space shuttle are continuously made by designers and engineers in NASA. In Mountain View, California, scientists use a computer model on their Cray supercomputer in order to simulate the air flow of a space shuttle in flight. As a result of their



*From a height of 255 feet above the ground, a space shuttle blast-off is even more spectacular.*

observations, the researchers displayed how air flow above the shuttle wings greatly injures the bulge toward the rear of the shuttle. Taking this into consideration, aerospace designers can understand how tiles on this section of the shuttle have been damaged during reentry. Now, attempts to strengthen the rear of the space shuttle are under way.

There is also an effort to build a lighter shuttle by replacing the steel motor case in the rocket booster. Weighing over 100,000 pounds, the motor case takes up most of the space shuttle's weight. Aerospace designers are now building a motor case made of composite material, that is, plastic strengthened with carbon fibers. NASA nominated Marshall Space Flight Center to make this new motor case. With this modification, shuttle missions can handle greater cargo capacity, like the Space Telescope that NASA will launch from the space shuttle in 1986.

*Lilimar Avelino*

## Magnetic Vortices May Hold Key to the Nature of the Universe

**R**ECENT observations of spiralling filaments of gas stretching across the galaxy have generated new ideas of the nature and role of magnetism.

The filaments or magnetic vortices which appear to be held together by some magnetic field have a whirlwind-like form. Although detected in 1984, the idea that magnetic vortices played a significant role in the cosmos was not taken seriously until now.

Contained in the magnetic vortices is plasma—an electrically charged gas. The plasma is confined by the magnetic field created by the flow, the plasma itself, and the electrical current it has internally. The particles in the plasma spin about an axis, giving it a whirlwind effect. It is estimated that over 90% of the universe consists of plasma.

For many years, there has been speculation that magnetic vortices could exist spread out across the large sections of space, moving close to the speed of light. Only recently have these filaments been observed. The vortices seem to come in all sizes: small half-mile across filaments from the atmosphere of Venus to giants that cross millions of light years.

The source of these vortices is also speculation. At this time, they appear to be enormous jets of super-hot matter shot into the universe from quasars or even the center of galaxies. These jets are still quite mysterious, because the width of the beam that is formed is only a tiny fraction in comparison to its length. This puzzled scientists for quite a while. Now, it is theorized that a magnetic field confines the plasma in the narrow jets. Inside the jets, electric current moves along the length of the plasma to take on the helical shape. The magnetic field itself is weak, estimated at one-ten thousandths of the strength of the

*Continued on page 11*

## Aircraft Industry Considers Switch Back to Propellers

**"A**CCORDING to many aerospace specialists, the soon-to-be-tested propeller-fan aircraft engines could represent a revolutionary change in commercial aviation. The companies working on the development of this engine are Lockheed-Georgia Co., General Electric, Pratt & Whitney, and Douglas Aircraft. Several designs have been proposed, and they will be tested either on a Boeing 727 or on a McDonnell-Douglas MD-80.

One might expect that propeller-driven engines would not be able to match the thrust produced by modern jet-turbine engines. Apparently, the propeller-fan engines are capable of producing up to 15,000 horsepower and will generate speeds of 550 miles per hour. More importantly, the new engines will produce power 30% more efficiently, which is the main reason for this research.

There are two main propeller-fan designs currently being studied. One is proposed by the Lockheed Georgia Company and the other by General Electric. The basic schematic of the G.E. design is shown in the illustration. The engine's power supply is the turbo jet generator, which intakes air and ignites the fuel

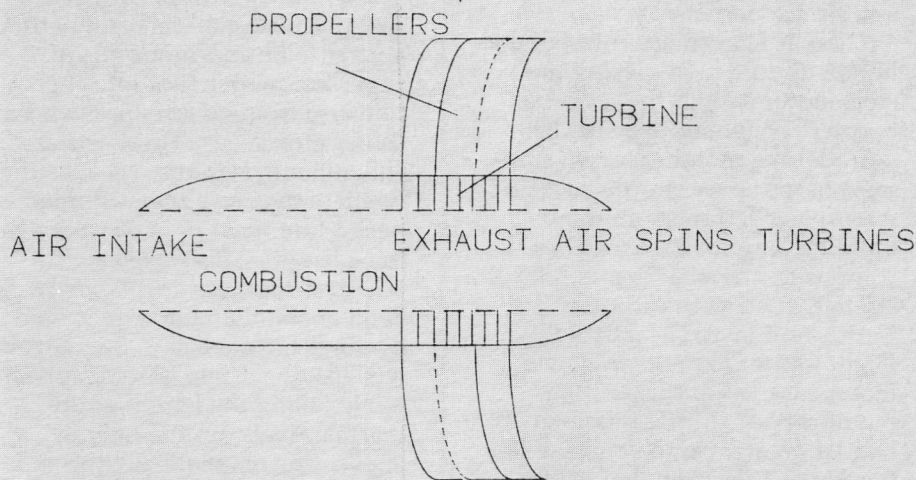
conventionally. The expanding gases are then fed through the turbine wheels, which drive the two sets of counter-rotating, scimitar-shaped blades. The Lockheed-Georgia Co. engine is of similar design but uses a gear box between the gas turbine and the propellers.

However, there is one disadvantage to this technology. The design engineers speculate that the noise produced by the propeller-fan engine could lead to problems due to strict environmental standards. At the moment, tests are being conducted on scaled-down models, and steps are being taken to reduce the noise output from the engine and noise output to the cabin.

Of particular interest to GWU engineering students is that the Lockheed-Georgia Co. engine was designed with the aid of CATIA. CATIA is a CAD/CAM software package developed by Dassault Systems Co., which will be available for use by GW students this fall at the SEAS computing facilities. Lockheed used CATIA to numerically control the machine tools that manufactured the engine.

Even though the engineers of these companies differ in design philosophy, they are all working hard to produce a feasible engine. What everyone does agree on is that this new technology could yield lower costs and higher revenues for the manufacturers.

*Stephen A. Osella*



*The propeller-fan engine resembles a cross between a jet engine and a conventional propeller engine.*

## World's Largest Telescope is Under Construction

**"T**HE California Institute of Technology and the University of California have begun a project to build the biggest telescope in the world. An oil tycoon, William Keck, gave \$70 million to support this effort. Today, Mount Palomar telescope in California is the largest, but this new giant telescope will be two times larger with a ten-meter long mirror.

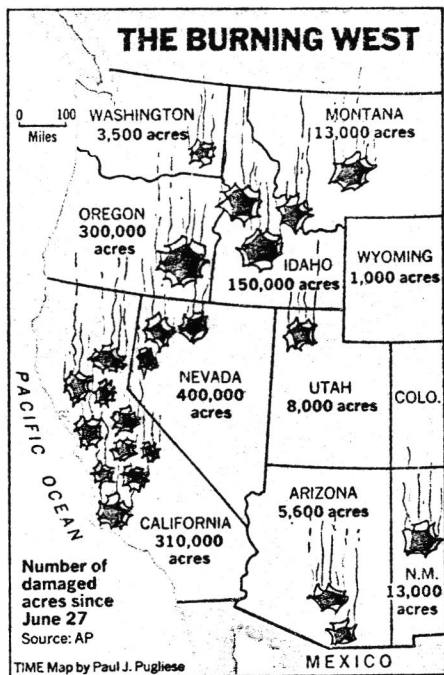
Making this gigantic mirror is a task within itself. The natural forces of gravity, bad weather, and changes in temperature must be considered. Instead of one big piece of mirror, designers will build a 36 segment mirror, which is easier to replace if only a small part breaks. Finally, a platform controlled by computer will adjust the mirror three hundred times a second. Construction on the telescope begins in Mauna Kea, Hawaii in 1986. With this technological development, astronomers will be able to see two times as far into the mysterious reaches of the universe.

*Lilimar Avelino*

## Fighting Forest Fires: Smokey the Bear Enters the Computer Age

**"F**OREST fires this past summer, particularly in the western states, were among the worst in our nation's history. Land area comparable to that of the state of Rhode Island was consumed.

This time Smokey the Bear and the legions of fire fighters didn't have to fight the fires with shovels and watchtowers alone. Welcome the "Zues Squad", otherwise known as the Initial Attack Management Systems office. This group of computer analysts and scientists used many recent advances in technology to direct



*More than one million acres in the western states were burned in this summer's forest fires. This map shows the most heavily affected areas.*

the fire-fighting effort. Among these were airplanes with highly sensitive heat detection devices, satellites, and computers.

The Zues Squad, which coordinates its work from the Federal Fire Center, can combine resources to pinpoint the location of a lightning strike, which is the cause of most forest fires. Strategically placed detectors that pick up the electromagnetic pulse of the lightning bolt are able to determine the proximity of the fire. The Squad knows its location one-tenth of a second later.

Another computer receives information from 245 remote fire-weather stations throughout the west. These new stations give up-to-date data on temperature, humidity, and wind speed in that particular locale-information not otherwise available to the National Weather Service. This information is fed into the "ignition probability data base", telling officials where the greatest chance of fire exists.

In many cases, in the initial stages of the fire, two fire fighters are parachuted into the area to build a fire line. Eighty percent of the time, this method is successful, and the fire which had massive destructive potential is out in a few

hours.

Once the fire starts to spread, the Zues Squad members leave their Boise, Idaho office and head for the fire area, bringing their computers to the scene with them. Coordinating data from pilots flying over the blaze and satellites, they direct the fire-fighting efforts. The planes flying overhead are equipped with infrared devices linked to the computer. They use these to produce a map showing the boundaries of the fire and where it is burning hottest. A specific weather prediction for the area affected is made by squad members. At this point, fire fighters can be told where to build fire lines, what direction the fire is headed, and its exact location, as well as where they can sleep when they need a rest!

According to the Robert Mutch of the Federal Fire Center, the use of high technology in fire fighting is just beginning. He pointed to a proposed satellite system that would predict potential fires by working with a land-based detector system. Mutch further explained that this summer's fires would have been almost 40% more destructive without the aid of the technology and the Zues Squad to use it.

*Jeff Winbourne*

## "LifeCard": Could It be a Lifesaver?

**B**LUE Cross and Blue Shield of Maryland will be providing 1.6 million of its subscribers with a new type of medical record called a "LifeCard". The LifeCard is a plastic card, shaped similarly to a credit card, that can display nearly a half million words and can therefore contain a complete medical history. The card will store complete individual medical data-up to 800 pages worth-including x-rays, electrocardiogram results, drug prescriptions, lab-test results, allergy alerts, and surgical history for instant access.

The policyholder's photo and

signature will be stored on the card to prevent misuse, along with details of insurance benefits. The data will be read by a personal computer and scanning devices.

If the Maryland test proves successful, LifeCard could be adopted nationwide by 1987. To insure privacy, special access codes would restrict reading of the data.

*April Stokes*

## Magnetic Vortices

*Continued from page 9*

magnetic force at the surface of the Earth. Yet, great amounts of electric current seem necessary to create them. An example of one jet shooting out of a quasar was 15,000 light years across and 600,000 light years long with approximately 2.5 million trillion amperes of current.

These jets carry a large number of high energy electrons, created by the plasma as it moves through the magnetic field. When the high energy electrons enter the Earth's atmosphere, phenomena such as the aurora borealis occur.

Although a smaller amount of charge is involved than is in giant jets, the power to create the Northern Lights is estimated at a million megawatts. That is nearly equal to the total electrical power generated on Earth.

The significance of these finding and the variation in the size of the jets indicates that magnetism may be more important than previously thought. Dr. Anthony Peratt, a plasma physicist at the Los Alamos National Laboratory says that up until now, the only way theorists could imagine dense concentrations of matter and energy was through gravitation. But now it is clear that magnetic forces can pinch matter and energy together to form these vortex filaments. It shows an exciting new process at work.

*Jeff Winbourne*

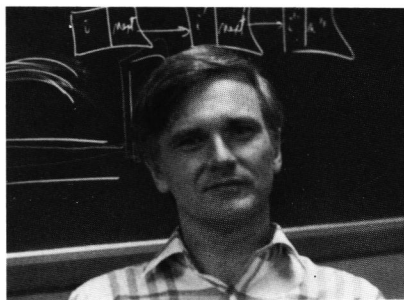


## Battling Berserk Robots: Computer Emulation of Numerically-Controlled Machining

**"N**UMERICALLY-controlled (N/C) machines receive their operating instructions from a computer, rather than by direct manual operation. Their operating instructions are generated by a computer program. Mistakes ("bugs") in this computer program can cause the N/C machine to veer in an incorrect path or at an incorrect speed with possibly disastrous and costly consequences. This research project is intended to take the N/C computer programs input to a second program which emulates the machining process in a computer, rather than on the N/C machine itself. This allows for early detection of errors so that the N/C program can be rewritten and tested anew.

The problem is made difficult since the emulation needs to describe the volume "swept-out" as the machine tool proceeds through its motion. The emulation program should provide a full 3D visualization of the machining process. Unfortunately, current 3D ("solid model") computer methods are better suited for representing an object, such as a tool or workpiece, in a static position-not as a dynamic entity undergoing complex motion. Our approach is to divide the workpiece up into cubic regions and note which/when a certain cube is intersected by the tool. If the cube is only partially "swept out", then it is sub-divided into eight smaller cubes (halving the x, the y, and the z dimensions), and

the smaller cubes are then tested for intersection. With this process, we are able to provide a 3D visualization of the N/C machining process that is continuously updated as the tool proceeds through its cutting motion.



KWANG-YONG QUEK

*Professor Donald M. Esterling is working on ways to better control automated machine tools.*

## What's Happening In . . .

### Tau Beta Pi

Tau Beta Pi, the National Engineering Honor Society for all engineers, was founded in 1885 at Lehigh University. In 1963, the George Washington University chapter was established.

Undergraduate Juniors and Seniors, Masters and Doctoral Candidates, as well as alumni and eminent engineers may be considered for induction.

This year, Tau Beta Pi will continue to sponsor tutoring in the Engineering core curriculum. This service is free to students who are enrolled in the School of Engineering and Applied Science. Specific information about the tutoring program will be available in late September. We are continually searching for other

community service project possibilities.

Another major Tau Beta Pi activity is inductions which are held each Fall and Spring Semester. The Spring, 1985 inductions were held on April 13. Three graduate and eight undergraduate students were inducted. Fall, 1985 inductions are scheduled for November. All members of Tau Beta Pi are welcome to attend inductions.



The officers for the 1985-6 school year are Anirudh Kulkarni (202-676-2427), President; Craig Spisak (301-248-2007), Vice President; Elizabeth Smith (703-525-1598), Corresponding Secretary; Jack Ades (202-342-0898), Recording Secretary; Enrique Alonso (202-887-0511), Treasurer. Our mailing address is Tau Beta Pi, GWU-SEAS, Tompkins Hall #103, Washington, DC 20052.

For more information about Tau Beta Pi or its activities, please feel free to contact any of us, or leave a message in our mail box (Tompkins Hall-Room 103). Alumni and other members are especially encouraged to contact the chapter.

*Elizabeth Smith*

### Eta Kappa Nu

The Eta Kappa Nu Association was established at the University of Illinois in 1904. It has grown from a small local chapter, then, to a national electrical engineering society, now, having branches and chapters in more than 200 locations throughout the United States, Europe, and Asia.

The GW chapter of Eta Kappa Nu was established in 1979, and, since then, the membership has grown to more than 120 students. EE/CS undergraduate students who have a cumulative scholastic rank in the upper quarter of their junior class or rank in the upper third of their senior class may be elected. Graduate students and faculty members with outstanding abilities, as evidenced by scholarship, personal character, voluntary services performed, and distinguished accomplishments are also eligible.



This semester, the GW chapter will again conduct a survey among the engineering student body to select the teacher of the academic year 1984/5. This is to emphasize among the faculty members of the EE/CS Department the value of their service to the students. In addition, the chapter will make suggestions for the school library to purchase books and periodicals that will help broaden our engineering ideas. The chapter will cooperate in implementing the tutoring program being pursued by Tau Beta Pi.

Students and faculty members who are interested in becoming a member of this society may leave a note in the Eta Kappa Nu mailbox in Tompkins Hall, Room 103.

*Victor Chen*

## What's Happening In . . .

### OR (Operations Research)

This summer was a time for quite a few developments in the Operations Research Department. These changes ranged from new appointments to awards for faculty members.

The department, which offers a Bachelor of Science degree in Systems Analysis and Engineering, announced that Dr. Nozer Singpurwalla received the 1984 Wilks Award from the Army's Mathematical Steering Committee. The award is primarily for his work in reliability theory and life testing methodologies.

Omega Rho, the international honor society for operations research, elected Professor Richard Soland to be its Executive Director/Treasurer.

Professor Douglas Miller was invited to travel to two universities in Argentina during June. His visit centered around discussions on research on probability models for polymer science. This work is related to coatings, rubber, and plastics.

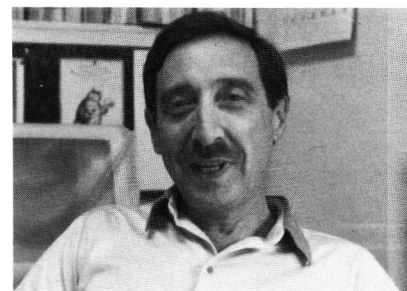
The department will have a visiting Professor this academic year. Dr. Thomas A. Mazzuchi will be teaching both graduate and undergraduate courses. Besides teaching, he will be doing research at the Institute for Reliability and Risk Analysis at Staughton Hall.

In the Fall of 1985, the operations research department will begin a new masters program. Called the Masters Program in Operations Research with a Concentration in Management Science, the program has a newly appointed director, Professor Rolf Clark.

The International Symposium

on Mathematical Programming invited Professors Anthony Fiacco and Garth McCormack to hold tutorials and present papers, respectively, at its August meeting held at the Massachusetts Institute of Technology.

*Donald Gross*



KWANG-YONG QUEK

*Professor Donald Gross returns refreshed from sabbatical leave to head the Operations Research Department.*

## Artificial Intelligence Professor Receives Grant

The Allied Foundation has awarded a \$5000 grant to The George Washington University for the 1985-86 academic year in recognition and support of work by Dr. Simon Berkovich in the fields of fault tolerance and artificial intelligence.

Berkovich is an associate professor in the Electrical Engineering and Computer Science Department of GW's School of Engineering and Applied Science.

According to a spokesperson for Allied Bendix Aerospace, "We feel very strongly that (Professor Berkovich) is a leader in his field, and we wanted to support his university and his work." The

award is part of an annual giving program by the Allied Foundation.

*By Terry Lowe-Edwards*

*GW Department of News and Public Affairs*

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*Dr. Simon Berkovich has received a \$5,000 grant from the Allied Foundation. Photo courtesy of the GW Department of News and Public Affairs.*

## BES (Black Engineering Society)

The GWU Black Engineering Society is a chapter of the National Society of Black Engineers (NSBE). "The NSBE is a national student-based and student-operated nonprofit organization which is dedicated to the realization of a better tomorrow through the development of intensive programs for increasing the participation of Black and other ethnic minorities in the fields of engineering and the engineering technologies." The following activities are the NSBE.

With genuine interest in incoming students, the BES set up a table at the Projects Visibility Fair on September 2 and held peer counseling sessions during the week of student orientation.

One of the major events of the semester was the Minority Engineers' reception, which was a welcome to the new minority engineers of GW. This was held on

September 7.

The main project on the agenda for this semester is our Career Fair, which will be held tentatively during the week of October 14-18. A resume book will be compiled and made available to the corporate representatives who will be present at the fair.

In addition to our chapter activities, some members of the GWU BES and NSBE will be attending the regional conference of the NSBE, which will be held in Pittsburg, PA on November 8, 9, and 10.

All students (minorities or otherwise) are eligible to join the BES. If you're interested, write to or visit: The Black Engineering Society/3rd Floor, Building H/G Street, N.W./Washington, DC 20052.

*Gayle Tyson*



## IEEE (Institute of Electrical and Electronics Engineers)

In October, the newly rejuvenated student branch of the IEEE will sponsor a Student Professional Awareness Conference (SPAC). This event is a non-technical conference devoted to enlightening students about the

professional world they will be entering upon graduation. Topics to be discussed are: obtaining employment after graduation, the value of post-graduate degrees, the IEEE and engineering professionalism, and mastery of communication skills in the professional world.

The conference is **free** to all SEAS students, faculty, and alumni. There will be several lectures and a refreshment break. Also, attendees may enjoy a buffet dinner in the newly remodeled



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University Club at a charge of \$7.00 for IEEE members and \$15.00 for non-members and guests.

There will be an opportunity for students to join the IEEE in September and to take advantage of the reduced price of the conference dinner. The benefits of joining include the reduced price discount for the dinner, as well as the monthly IEEE Spectrum and Potentials magazine subscriptions. Students, faculty, and alumni will be receiving a registration form and brochure in the mail soon, containing information about the conference program.

The conference is scheduled for Thursday, October 17, 1985, starting at 1:30 PM and continuing until 8:30 PM that evening. If there are any questions involving registration, times, or locations, please call any of the following people: Andrew Lacher, Chairman, at (703) 525-1598, Bob Simmers, Secretary, at (703) 243-0823, or Mark Abolafia, Vice Chairman, at (202) 872-0404.

Further on in the semester, the  
*More Campus News on page 16*

## IRS . . .

Continued from page 7  
withheld by employers and interest and dividend payments. Taxpayers would receive a printout showing how their liability was determined. If everything checked out, they would simply send off a payment. The agency estimates this would save taxpayers some 97 million tax preparing hours annually, and more than \$1.9 billion in fees paid to professional tax preparers each year.

Initially, the return-free option would be extended by the IRS in a pilot program to the users of the simplified 1040EZ form only. A year later the program would be expanded to serve users of the 1040A form.

For people with complex financial transactions, however, tax returns would still be required. But those people will also benefit from the new system. IRS planners hope to allow taxpayers with complex returns to deliver their 1040 forms electronically to an IRS computer. There is, however, one problem remaining to be solved: how the taxpayers would sign their returns.

With all these computer problems, the paperless filing program will have to wait until the IRS can once again become a model for efficiency. ■



KWANG-YONG QUEK

April Stokes is a junior majoring in Computer Engineering. In addition to being Associate Editor of *MECHELECIV*, she is Vice President of GW's Black Engineers' Society. This fall, April will be working as a co-op student for the Xerox Corporation in Rochester, New York.

## More Campus News

Continued from previous page

Student Branch of the IEEE also plans to sponsor the Student-Faculty Reception again, which was a fantastic success last year. Other activities and fund-raisers as well as a book buy-back program and job fair are being planned. We look forward to an excellent conference and a successful year for the IEEE.

Mark Abolafia

## What's Happening In . . .

### ASCE (American Society of Civil Engineers)

ASCE is a student organization that helps civil engineering students learn **about** civil engineering. The chapter allows members to mature to professional status more rapidly, by supporting the educational program with career-oriented activities.

For those of you who are just entering GW as a civil engineering student, there is generally a lack of a strong sense of identification with your chosen field of study. Consequently, chapter participation encourages you to become aware of the link between education and professional practice. In addition, contact with and socializing with professors and other fellow civil engineering students is an important aspect of student development.

Here at the GW Student Chapter of ASCE, we are an amiable group of people who always welcome new members. For those of you who are not already members, come join us and meet your fellow civil engineering colleagues.

Last year, we were involved in many activities, including a field

trip to the Blue Plains Wastewater Treatment Plant, and we had a "Celebrate Springtime" Barbecue with students and faculty.

This year, we plan on taking another field trip to a steel fabricating plant or to a building construction site. In addition, we are planning a major social function, and International Food Festival.

In order to have a successful year as a student organization on campus, we need many devoted



members to join ASCE. It is required that only students who are currently studying civil engineering at GWU join the ASCE chapter. There is a small fee for becoming a member of ASCE. This fee includes a one-year subscription to the publications *Civil Engineering* and *ASCE News*. In addition, the various activities that are planned for this chapter will be subsidized by the membership dues.

To become a member, fill out an application form and pay a \$5.00 check (or money order) to A.S.C.E. and a \$5.00 check or money order to A.S.C.E.-GWU Chapter. Application forms are available at the Academic Center, Room T-730 (speak to Jimmie Roberts.) For further information about ASCE, please call Ilene Belkin at (202) 887-8274.

Ilene J. Belkin



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